

Determining the effects of operational offshore wind farms on harbour porpoise distribution and foraging behaviour in the North Sea

Aoufi Sofya¹, Rumes Bob¹, Debusschere Elisabeth², Paoletti Silvia¹ and Degraer Steven¹

¹ Marine Ecology and Management, Institute of Natural Sciences, Vautierstraat 29, 1000 Brussel, Belgium
E-mail: sofya.aoufi@naturalsciences.be

² Marine Observation Center, Flanders Marine Institute (VLIZ), Jacobsenstraat 1, 8400 Oostende, Belgium

The North Sea is an important region for anthropogenic activities ranging from maritime traffic, gas and oil mining, gravel and sand extraction, fishing, and aquaculture to renewable energy (Moullec et al., 2021). The North Sea is expected to host 300 GW of wind energy by 2050, making wind farms the most important anthropogenic activity next to fisheries. Therefore, it is crucial to investigate how these operational wind farms will affect the marine environment.

Around 340.000 harbour porpoises of the estimated global population size (700.000) are present in the North Sea, proving it to be a vital habitat for these cetaceans (Hammond et al., 2002). Harbour porpoises generate echolocation clicks to navigate, forage and communicate, making them sensitive to noise pollution from offshore wind farms, maritime traffic and offshore construction work amongst others (Wisniewska et al., 2016). Most studies on offshore wind farms have focused on the effects of construction noise on harbour porpoises with only a few recent studies characterizing the operational wind farm noise and its potential effects. Hence, the importance for species conservation and mitigation measures to assess how these anthropogenic noise sources influence their behaviour and distribution in a growing wind energy industry.

We use passive acoustic monitoring to investigate how operational offshore wind farms influence the foraging behaviour and small-scale distribution of harbour porpoises. We will determine how harbour porpoises respond to the operational noise generated by the moving mechanical parts in the nacelle and whether they are attracted by the foraging opportunities offered by the artificial reefs created around the turbines.

The study site is located in the Belgian Part of the North Sea and makes use of tripod-mounted cetacean loggers stationed within 1) the operational offshore wind farms and 2) around marine traffic lanes. Acoustic data at the offshore wind farms will be collected continuously for approximately a year along a gradient of increasing distance from the closest turbine. Hydrophone data and windspeed will be collected to characterise the environment.

The acoustic data retrieved from the cetacean loggers provide information on species presence and behaviour through the recorded click characteristics and frequencies. Such response variables will be analysed in timeseries and general additive models to assess the hypothesis that harbour porpoise distribution and foraging behaviour changes as a function of the presence of artificial reefs and levels of operational offshore wind farm noise. This research will provide crucial information on operational noise effects with implications to improve cetacean management and conservation in heavily used areas like the North Sea.

This research is part of PURE WIND, an UN Ocean Decade endorsed project that aims to study the effects of operational offshore wind farms on several parts of the food web, ranging from top predators like seals and harbour porpoises to zooplankton.

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Keywords

Harbour Porpoise; Foraging Behaviour; Operational Offshore Wind Farm Noise; Artificial Reefs; Passive Acoustic Monitoring